361
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CARE OF AQUARIUM FISHES

Prepared in the Branch of Fishery Biology

The widespread hobby of keeping home aquaria has emphatically impressed upon the public mind the fact that more is required to keep fish alive and healthy than merely putting a few fish in some water, and changing the water or throwing in a little food at irregular intervals. Anyone who has attempted to keep an aquarium has learned that fish require regular attention and constant care to preserve the proper conditions, and that each species has its own requirements for best growth. Many people have been led to disappointment by listening to enthusiastic aquarium owners who derive so much pleasure from their hobby that the painstaking care becomes so relatively unimportant that it is not mentioned, or at least is minimized.

In spite of the wide variety of environmental conditions required by the various species, certain general rules have been established that are applicable to the care of any aquarium fish. Four things are fundamental to a successful aquarium: (1) sufficient oxygen, (2) correct temperature, (3) correct feeding, and (4) proper light. Or, to approach the problem of maintaining a successful aquarium from the other direction, the following may be given as the main causes for failure: (1) overcrowding, (2) overfeeding, (3) sudden temperature changes, (4) lack of proper plant life, and (5) insufficient lighting.

The problem of sufficient oxygen is closely associated with the admonitions against overcrowding and lack of proper plant life, as well as with the differing oxygen requirements of the different species. Aquaria without plant life, or means of artificial aeration, are dependent upon the oxygen absorbed by the air. In these aquaria the surface area is the determining factor rather than is the volume. It is generally considered a safe practice to allow 25 square inches of surface for each inch of fish in the aquarium. Aquaria receiving oxygen from plants or artificial aeration can support a proportionately denser population. It is likewise true that certain species require less oxygen than others and, consequently, will thrive under more crowded conditions. If the advice of authoritative books or successful owners concerning individual species is not available, it is advisable for the beginner to understock his aquarium rather than to overstock, with the chance of losing his fish.

The factor of right temperature is one that must be determined for each species. Most aquarium fishes will tolerate a temperature range of about 10°F. The usual temperature range for tropical species is from about

70° to 80° F., while goldfish and native minnows do well in somewhat lower temperatures. Sudden changes in temperature are fatal to all species regardless of whether the temperature is raised or lowered. In changing the water or in transferring fish from one aquarium to another, differences of more than 2°F. must be avoided.

Closely associated with temperature is the factor of light. Direct sunlight, or light derived from high power electric bulbs, tends to raise the temperature. It is generally accepted that a northern exposure which allows for about two hours of direct sunlight each day is to be preferred. Of course, other exposures that allow for more direct sunlight are not necessarily detrimental, since proper shades can be used. Direct sunlight is not an absolute necessity because artificial light has proved to be equally satisfactory.

The effect of light on plants is possibly its greatest effect on an aquarium. Plants are provided for the purpose of supplying oxygen and are able to do this only in the presence of light. Fortunately, plants are activated to produce oxygen by the red end of the light spectrum, thus making electric light as effective as sunlight for practical aquarium purposes. It is a general practice to plant the ends of an aquarium rather heavily with the desired plants, leaving the center third entirely open or only sparsely planted. The owner has a considerable range from which to choose his plants. Five rooted plants have become more or less standard: they are Myriophyllum, Cabomba, Anacharis, Vallisneria, and Sagittaria. The first three plants have runner-like stems to which the leaves attach, while the latter two are grass type plants. Other rooted plants may be used, largely for decorative purposes. Duckweed and Riccia are the two more commonly used floating plants, both of which offer support for surface floating eggs and a place for the tiny fry to play hidden from their cannibalistic parents.

In connection with even such a brief mention of plants, one should call attention to the so-called green water. This is caused by an excess growth of tiny plants called algae. It is not serious in many cases and often can be corrected by reducing the light.

Feeding is to a large extent determined by both oxygen and temperature since both of these factors have a direct effect on metabolism. Fish should be fed once or twice daily, depending on their activity and food demand, but in no case should they be fed more than they will eat within a few minutes' time. Unused food must be removed promptly to prevent fouling of the water. Snails and scavenger fishes are frequently kept for this very purpose.

There are many brands of fish foods marketed but no really authentic tests have been made to evaluate the merits of each. The usual prepared food consists of fish or meat flakes mixed with coarse flour or some cereal. Puppy biscuits even make an acceptable food in an emergency. Live foods such as daphnia, mosquito larvae, and chopped earthworms should be used occasionally for best growth. Some young fish feed greedily on infusoria while they are too small to take the daphnia. Infusoria are those one-celled animals that develop in a culture of dried hay in pond water.

In spite of the tremendous differences in requirements for oxygen, temperature, food, and light demanded by the various species, it is not necessary that only one species be kept in an aquarium. Many species have such similar requirements for the four essential factors that one set of conditions will be suitable for several species. It is obviously unwise to group vicious or pugnacious species, but species having even tempers and non-aggressive natures may be grouped successfully. It is believed that some of the smaller more timid species do better when kept by themselves.

With so many demands made on the owner to keep his aquarium in a healthy condition, it is indeed fortunate that fewer diseases and parasites attack aquarium fishes than are found attacking fish in their wild habits. Even so, there are a considerable number of ailments affecting aquarium fishes that, as yet, can be treated only with general treatments and a hope. Our knowledge of the causes of fish ailments is sadly inadequate, and our methods of treating diseases when the cause is known are still largely experimental.

THE TREATMENT OF FISH DISEASES

Illness among fishes may become apparent in many ways. As a general rule, an ailing fish appears listless and is inclined to rest upon the floor of the aquarium or tank, or float at the surface of the water with little or no desire for food. Often an infected fish assumes a grayish cast or a darkening of the normal coloration. Patches of cottony white fungus along the side or back of a fish are certain evidences of disease. If one fish becomes affected, usually all in the tank are in a similar condition and should receive treatment.

Many diseases of fish are caused by small, usually microscopic organisms which are dependent upon the fish for their existence. Some of these microscopic organisms find congenial surrounding only in the body muscles or the internal organs of the fish. These organisms, known as endoparasites, are of little concern from the standpoint of treatment, for there are no methods known at the present time for effectively combatting them, and all hope for the survival of the infected fish lies in a spontaneous natural recovery. The majority of the disease producing organisms live on the external body surfaces or the gills where they may do extensive damage by actually attacking the tissues or by opening up avenues in the skin through which more pathogenic organisms may gain entrance. Such external parasites, or ectoparasites, often may be killed by immersing the infected fish in a disinfecting solution which will prove fatal to the parasite before it does to the fish. However, no method of treatment will kill the parasites without inflicting a certain degree of injury to the fish, hence successful cures can be realized only by applying treatment during the early stages of the disease before the fish is so weakened that it cannot withstand the additional rigors of treatment. Even so, treatments cannot be relied upon to check effectively disease in all instances. Preventing diseases by strict sanitation and intelligent management is far more successful than attempting to cure them by treatment.

METHODS FOR TREATING FISH DISEASES

Precautions

Unfortunately, no hard and fast rules may be drawn for administering treatments to diseased fish. The marked variation in such factors as the condition of the fish, the virulence of the strain of organisms present, and the chemical reaction between the particular water in use and the disinfectant precludes any possibility of evolving a definite formula which will be successful in all instances. Rules for treatment, therefore, must be regarded as merely standards from which one must vary a treatment according to the local conditions.

Whenever possible, treatments should be administered in special containers, preferably glass, and a few fish treated at a time. After treatment, the fish should be kept apart from the healthy ones for a few days in well-aerated water. Fish undergoing treatment should be watched closely and moved to fresh water immediately upon evidence of marked distress. Sudden changes of temperature must be avoided. Solutions should not vary in temperature more than 2°F. as determined by a reliable thermometer. Fish should never be grasped in the hands, as they may be seriously injured. A dipnet made of a soft fabric should be used for transferring the fish from one solution to another, and all handling reduced to an absolute minimum. Small amounts of water should be aerated frequently by withdrawing a dipperful and pouring it back slowly from the heighth of a foot or two.

The most common disease is "Ich" or more properly Ichthyophthiriasis, caused by the protozoan parasite Ichthyophthirius Multifilis. The symptoms are white pustules caused by the parasite invading the skin of the victim. The use of four drops of 2 percent mercurochrome per gallon of water is the favorite remedy of some people. Others prefer two drops of 5 percent aqueous solution of methylene blue per gallon of water, while still others recommend two level tablespoonfuls of table salt in each gallon of water. (See "Treatment with Weak Salt Solution").

Another common disease is Saprolegnia, or white fungus. This fungus never attacks the fish primarily but appears as a secondary invader following the death of tissue. When one notices the white tufts of this fungus, without other apparent ailments, it is a certain indication of trouble. Treatment with strong salt solution is an effective cure. (See "Treatment with Strong Salt Solution").

The protozoan parasites Chilodon and Cyclochaeta are common in aquarium fishes. These parasites give little evidence of their presence until they become numerous, then the fish lose their appetites and show a tendency to lie on one side on the bottom of the aquarium. The most effective treatment seems to be the strong salt solution described for Saprolegnia, or white fungus. The acetic acid bath recommended for fishes is also effective.

Flukes, or flatworm infections, are caused by the parasitic worm Gyrodactylus. The infection may occur on any part of the body, but is usually more common at the base of the dorsal and caudal fins. The symptons are rubbing against the sides or bottom of the aquarium in an evident attempt to rub off the worms. Such behavior indicates the necessity for an acetic acid bath. (See "Treatment with Acetic Acid").

It is not uncommon for an aquarium owner to find that the outer margins of the fins begin to disintegrate. This is usually a case of fin and tail rot. The disintegration is caused by a bacterial infection, and if not checked will eventually destroy the entire fin. Copper sulphate is effective in treating this disease, but care must be exercised in its use because it is highly toxic. (See "Treatment with Copper Sulphate").

In treating fish diseases by dipping, it should be recommended that not only are the chemicals used destructive to the parasites, but they also are more or less injurious to the fish. If fish diseases are treated immediately after the first symptons are observed, the fish will tolerate the treatment and regain perfect health. If, however, treatment is delayed until the disease gains a solid foothold and materially lowers the resistance of the host, the combined effects of the treatment and the disease may be too much for the fish to withstand.

If it can be avoided, fish should never be grasped in the hands, as they are often seriously injured thereby. A dipnet should be used in transferring them from one solution to another in order to reduce the handling to a minimum.

Sudden changes in temperature should be avoided. The dipping solution and the fresh water should be of approximately the same temperatures as that of the original water from which the fish were first taken.

Small amounts of water may be conveniently aerated by frequent withdrawing and pouring back a dipperful of the water.

After treatment, the fish should be kept apart from the healthy ones in well aerated water and should be sparingly fed with nutritious food.

Treatment with Strong Salt solution:

The fish are placed in a 3 percent solution of sodium chloride. This strength of solution is easily obtained by dissolving five level teasponnfuls of common table salt in one quart of water. They should be kept immersed in this bath, with frequent aeration of the solution, until they evidence symptons of distress by partially or completely turning on one side. Fish undergoing treatment should be closely watched. A vessel containing fresh, well aerated water should be at hand to receive the treated fish. This treatment may be repeated profitably daily for two or three days.

Treatment with Weak Salt Solution:

The fish are placed in a solution of salt water for a week to 10 days, The solution should be made by dissolving two level teaspoonfuls of table salt in each gallon of water. Practically any fish can stand this treatment. The solution should be renewed every two to three days. The bath should be aerated frequently.

Treatment with Acetic Acid:

The fish should be dipped in a solution of one part of glacial acetic acid in 500 parts of water. They should be allowed to remain in this solution for one to two minutes (one minute in a fresh solution; 2 minutes in a solution that has been used four or five times, or for four or five fishes). The gills of the fish usually turn quite dark in this bath. After the minute or two has passed, the fish should be placed in a vessel containing fresh water to recuperate.

If glacial acetic acid is not available, 6 teaspoonfuls of vinegar in one pint of water may be substituted.

Treatment with formalin:

Probably the most effective treatment for the removal of Gydrodactylus and external protozoan parasites is to place the fish for one hour in a weak solution of formalin. This is prepared by adding 1 part formalin (40% solution of formaldehyde) to 4,000 parts water. The fish are allowed to remain in the solution for one hour and, unless in a weakened condition, are not appreciably injured by the treatment. If many fish are being treated, it will probably be necessary to aerate the water from time to time. This treatment is of no value in combatting bacterial infections.

Treatment with potassium permanganate:

The fish should be dipped for 20 minutes in one-half grain of potassium permanganate dissolved in one gallon of water. This method was recommended by Dr. Ulric Dahlgren for eradicating the copepod Argulus from goldfish and tropical fishes. Because of the difficulty in weighing such a small amount of this reagent, it is probably advisable to obtain this quantity from a reliable drug store.

Treatment with Copper Sulphate:

In using copper sulphate, it is advisable to vary the strength of the solution and duration of the treatment according to conditions. This is due to the fact that the solution is very toxic, the amount of injury being dependent upon the condition of the fish. If they are weakened from disease or any other cause, they are often unable to withstand a solution which would have no appreciable effect on strong healthy fish. Furthermore, different species of fish differ widely in their resistance to copper sulphate treatment. Such hardy species as the black bass or the goldfish can be placed without harm in a solution which would cause serious injury to more delicate species such as the trout, tropical fishes, or crappie.

In general, the treatment consists in placing the fish for one to two minutes in a 1 to 1,000 solution of copper sulphate (blue vitriol). Because of the high toxicity of copper sulphate, this solution is probably best made by purchasing one gram of the reagent from a reliable druggist and dissolving it, when needed, in one quart of water. One should request hydrated copper sulphate and avoid anhydrous copper sulphate. The solution should be made just before using by adding one part of copper sulphate by weight to 1,000 parts of water. Treatment should be given in a wooden or glass vessel, as copper sulphate will react chemically with metals. At the conclusion of the treatment, the fish should, if possible, be placed in running water to allow them to recuperate.

If necessary, the treatment may be repeated at intervals of 24 hours or more without injury to the fish. In the case of less resistant species, or if the fish have previously been weakened, they should not be exposed to the solution for more than one minute. In some instances, a 1 to 1,500 or even a 1 to 2,000 solution has been used with good results, but the weaker solutions are, of course, less effective and should only be resorted to when for any reason it is inadvisable to use a 1 to 1,000 solution. In case definite lesions are present on the fish, it is best to treat these locally with a one percent solution of copper sulphate. It can best be applied by gently swabbing the lesion with a bit of absorbent cotton which has previously been dipped in the solution. Two or three applications at intervals of 6 to 12 hours should be sufficient. After each local application of copper sulphate, the fish should be placed in a 1 to 1,000 solution for one minute.

The treatment is less injurious to the fish if the copper sulphate is dissolved in a 2-3% solution of common salt (sodium chloride). This is due to the fact that copper sulphate is not directly toxic, but injures the fish by coagulating the mucus on the gills, forming a covering which interferes with respiration. Salt has a tendency to remove the mucus and thus alleviates the effect of the copper sulphate.

The aquarium owner must go farther than treating his fish in order to rid his pets of disease. When a disease has started in an aquarium the aquarium itself becomes a potential source of reinfection. The following are some general procedures that have proven effective in ridding the aquarium of disease-producing organisms.

Sterilization of Tanks:

Tanks may best be sterilized by washing with a strong solution of potassium permanganate, strong salt solution, or chloride of lime solution. All animals and plants should first be removed. Never use soap about an aquarium as it is very fatal to fish life. Glass aquaria with cemented joints or seams never should be allowed to dry out.

Sterilization of Plants:

It is easy to kill plants when disinfecting them. The following treatment, however, is believed to be about as safe as any that could be recommended:

Dissolve one ounce of powdered alum in one gallon of water; place the plants in this solution for from 10 to 20 minutes. A 10-minute treatment is sufficient for killing small protozoan organisms, while a 20-minute treatment is enough for killing small crustaceans, aquatic insects, worms, and insect larvae.

The plants should be washed in running water for five minutes after the treatment; they are then ready for use in the aquarium or pool.

For disinfecting tanks without removing plants (fish should be removed, as well as other animals, snails, etc.), use one-fourth of an ounce of alum to every gallon of water and allow it to stand until a white precipitate is formed on the bottom of the tank. The water may then be siphoned off and the tank refilled with fresh water.

The sand may be sterilized by washing thoroughly and drying either in the sun or in an oven.

Unquestionably, there are ailments of fish which are unknown as yet. Still more diseases are known, but no satisfactory method of treatment has been evolved. However, in the case of the commoner diseases, the cause and a reasonably satisfactory cure are known. Although the commoner diseases are well known, very few of them present specific lesions visible to the unaided eye, hence it is highly advisable to have any ailing fish examined by a competent fish pathologist so that a correct diagnosis may be obtained and the proper treatment administered. If a microscope is available, many parasitic diseases may be diagnosed by the laymen with the assistance of an adequate description of the commoner fish parasites. In any event, indiscriminate treatment of fish is to be avoided. Most diseases which can be controlled will respond favorably only to a specific method of treatment, and the application of any other method is worse than useless. The following table gives the specific treatment for the commoner ailments of fishes:

Disease	Type of fish to be treated	Treatment
Costia, Chilodon, Cyclochaeta and other protozoan infections. (Excluding Ichthyophthirius)	All types	Strong salt solution (1) Weak solution of formalin (4)
Ichthyophthirius infections	Tropicals	Weak salt solution at 80°F (2)
	Goldfish	Weak salt solution (2)
	Trout-salmon	Increased water flow (2)
Gyrodactylus infections	All types	Acetic acid (3) Weak solution-formalin (4)
Copepod infections, fish lice	All types	Potassium Permanganate (5)
Bacterial infections Localized	All types	Swab with disinfectant such as 1% copper sulphate, iodine, mercurochrome
General	All types	Copper sulphate (6)
White fungus (Saprolegnia)	All types	Strong salt solution (1) or, Swab localized patched with 5% aqueous solution of malachite green.

This account is admittedly incomplete, but it is hoped that it will prove to be of some value to the home aquarium owner who is pursuing a difficult but intensely interesting hobby. The joys attending success more than compensate for the work and worry of attainment.

Fearnow, E. C. - Goldfish: Their care in small aquaria and ponds. Bureau of Fisheries, Fishery Circular No. 6, Oct. 1913. 5 cents. (For sale by Superintendent of Documents, Gov't Printing Office, Washington, D. C.)

Innes, Wm. T. - Goldfish Varieties and tropical aquarium fishes, 300 pages, illustrated. Innes Publishing Co., Philadelphia, 1921. $4.00.

Innes, Wm. T. - The Modern Aquarium. 62 pages, illustrated. Innes and Sons, Philadelphia. 1931. $1.00.

Innes, Wm. T. - Exotic Aquarium Fishes. 463 pages, illustrated. Innes Publishing Co., Philadelphia, 1935.

Mellen, Ida M. - Fishes in the Home. 178 pp. illustrated. Dodd, Mead and Company, New York, 1928. $1.75.

Mellen, Ida M. - Tropical Toy Fishes. In National Geographic Magazine, March, 1931. pp. 288-317. 34 colored illustrations of Tropicals. National Geographic Society, Washington, D. C. 50 cents.

Aquatic Life. (A monthly magazine.) 614 N. Chester St., Baltimore, Md. $1.50 a year; 15 cents a copy.

The Fish Culturist. (Issued monthly except in summer, by the Pennsylvania Fish Culturists' Association, Philadelphia.) $1.00 a year.

The Aquarium. (A monthly magazine.) Innes Publishing Co. Philadelphia. $2.00 a year; 20 cents a copy.

48404